



## EPA Region 7 TMDL Review

**TMDL ID:** MO\_3230  
**Document Name:** SHOAL CREEK

**State:** MO

**Basin(s):**  
**HUC(s):** 11070207  
**Water body(ies):** SHOAL CREEK  
**Tributary(ies):** JOYCE CREEK (3233), POGUE CREEK (3232), SHOAL CREEK (3231)  
**Pollutant(s):** BACTERIA

**Submittal Date:** 10/2/2007

**Approved:** Yes

### Submittal Letter

*State submittal letter indicates final Total Maximum Daily Load(s) (TMDL) for specific pollutant(s)/water(s) were adopted by the state, and submitted to EPA for approval under section 303(d) of the Clean Water Act [40 CFR § 130.7(c)(1)]. Include date submitted letter was received by EPA, date of receipt of any revisions, and the date of original approval if submittal is a phase II TMDL.*

The TMDLs for Shoal Creek(3230 and 3231), Joyce Creek (3233) and Pogue Creek (3232) were formally submitted by the Missouri Department of Natural Resources (MDNR) in a letter received by the United States Environmental Protection Agency (EPA) on October 2, 2007.

A TMDL for Shoal Creek (3230) was approved on 11/18/2003 for Fecal Coliform.

### Water Quality Standards Attainment

*The water body's loading capacity (LC) for the applicable pollutant is identified and the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources is described. TMDL and associated allocations are set at levels adequate to result in attainment of applicable water quality standards (WQS) [40 CFR § 130.7(c)(1)]. A statement that WQS will be attained is made.*

The LC for Shoal Creek TMDL is a continuous curve calculated from discrete loading capacities over a range of flow conditions. Specific LCs are calculated by taking the flow times the 200 col/100ml WQS times a conversion factor. The LC at 15-50% flow probability is:

Shoal 3230 = 4.4492E+11 cfu/day  
Shoal 3231 = 7.1632E+10 cfu/day  
Joyce 3233 = 7.7416E+10 cfu/day  
Pogue 3232 = 5.7840E+10 cfu/day

EPA agrees that the LC and the associated allocations are set at levels that are adequate for attainment of WQS.

### Numeric Target(s)

*Submittal describes applicable WQS, including beneficial uses, applicable numeric and/or narrative criteria. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, site specific if possible, was developed from a narrative criterion and a description of the process used to derive the target is included in the submittal.*

#### Beneficial Uses:

Shoal Creek WBID 3230

- Livestock and Wildlife Watering

- Protection of Warm Water Aquatic Life
- Protection of Human Health (Fish Consumption )
- Cool Water Fishery
- Irrigation
- Whole Body Contact Recreation – Category A
- Secondary Contact Recreation

Shoal Creek WBID 3231, Pogue Creek WBID 3232 and Joyce Creek WBID 3233

- Livestock and Wildlife Watering
- Protection of Aquatic Life
- Protection of Human Health (Fish Consumption )
- Whole Body Contact Recreation – Category B

**Length of Impaired Segments:**

3230 – Shoal Creek 13.5 miles  
 3231 – Shoal Creek 4.0 miles  
 3232 – Pogue Creek 2.5 miles  
 3233 – Joyce Creek 5.0 miles

**Location of Impaired Segments (downstream to upstream):**

3230 – Shoal Creek: Capps Creek at N ½ Section 15, T25N, R29W to Section 12, T23N, R29W  
 3231 – Shoal Creek: Section 12, T23N, R29W to Highway 86  
 3232 – Pogue Creek: Mouth to Section 32, T24N, R24W  
 3233 – Joyce Creek: Mouth to Section 16, T24N, R28W

**Use that is impaired:**

Whole Body Contact Recreation

**Standards that apply:**

Missouri's WQS at 10 CSR 20-7.031(4)(C) state:

Protections of whole-body-contact recreation is limited to classified waters designated for that use. The fecal coliform count shall not exceed two hundred colonies per one hundred milliliters (200 col/100 mL) during the recreational season in waters designated for whole-body-contact recreation or at any time in losing streams. The recreational season is from April 1 to October 31.

Stormwater in the standards is difficult to apply because there is no definition of what constitutes stormwater flow. In this TMDL, stormwater is addressed in the Load Duration Curve (referred to in the TMDL document as a Load Frequency Curve). The curve is the 200 col/100 mL standard and different loads apply to different flows.

**Pollutant(s) of concern**

*An explanation and analytical basis for expressing the TMDL through surrogate measures (e.g., parameters such as percent fines and turbidity for sediment impairments, or chlorophyll-a and phosphorus loadings for excess algae) is provided, if applicable. For each identified pollutant, the submittal describes analytical basis for conclusions, allocations and margin of safety (MOS) that do not exceed the LC. If submittal is a phase II TMDL there are refined relationships linking the load to WQS attainment. If there is an increase in the TMDL there is a refined relationship specified to validate the increase in TMDL (either load allocation (LA) or waste load allocation (WLA)). This section will compare and validate the change in targeted load between the versions.*

Due to the nature of point source versus nonpoint source contributions to fecal coliform loading, a continuous curve calculated from discrete LCs over a range of flow conditions was used to link fecal coliform water quality loading to sources. Nonpoint contributions to the load are strongly correlated with high flow conditions and runoff from rainfall events. Point source contributions will dominate the loading when the stream flow is low. The targeted criterion is directly linked to Missouri WQS. The Soil and Water Assessment Tool (SWAT) was used to simulate Fecal coliform loading.

The only modification to the previous phase I TMDL was the addition of the other three segments including WLA, LA, and MOS.

**Source Analysis**

*Important assumptions made in developing the TMDL, such as assumed distribution of land use in the watershed, population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources, are described. Point, nonpoint and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered. If this is a phase II TMDL any new sources or removed sources will be specified and explained.*

No point sources exist in the watershed that would account for the high levels of fecal coliform found in the creek. There are many potential nonpoint sources. These include livestock, poultry litter, other domestic animals (horses, dogs, and pigs), failing septic systems and wildlife. The George's poultry processing plant, located in Butterfield, may also be a nonpoint source of bacteria. The plant effluent is spread on hay fields and has the potential to run off during rain events.

#### **George's Processing, Inc. (permit #MO-0108618)**

Data shows that an average of three inches (76 mm) of effluent has been spread on 380 acres since July 1997. The plant is planning to increase its processing capacity, which will increase the applied volume of wastewater. The number of irrigated acres is scheduled to double from 380 acres to approximately 600 acres. When George's data was modeled, it was done on the basis of three inches of wastewater over 380 acres of canary grass hay.

#### **Poultry litter spread on pastures**

Grassland areas are used as pastures, hay fields and for fescue seed production. In the spring, about 50 percent of the pastures are fertilized with poultry litter at a rate of two tons per acre. Another 25 percent of the pasture acres and all the hay and fescue seed fields are fertilized with inorganic nitrogen fertilizer. Twenty-five to 33 percent of the grassland is never fertilized for technical reasons (high slopes for example) or financial reasons (inability to buy the fertilizer or poultry litter).

There are approximately 60 poultry producers in the Shoal Creek watershed. Concentrated Animal Feeding Operations (CAFOs) are classified according to size. Poultry operations range in size from one house to CAFO class IB (14 to 30 houses). It is assumed that each house produces 120 to 125 tons of poultry litter per year and it is spread within 10 miles of the poultry house.

#### **Livestock**

Livestock in the Shoal Creek Watershed include cattle, dairy cows and a few horses. Barry County agricultural facts indicate that there were about 4700 cow/calf pairs in the watershed and 75 steers and bulls in 1998 (Missouri Agricultural Statistics Service, 2002). NRCS sources indicate 25 dairy farms in the watershed as of 1999. Given an average size of 60 cows per farm, this would represent about 900 cows. It is estimated about half of the cattle are kept in confinement and the rest are grazing in pastures. This yields about 5000 animals grazing in pastures year round.

By a rough estimate, there are approximately 300 horses in the upper Shoal Creek watershed. DNA analyses of the water samples collected at the Highway 97 Bridge identified horse fecal coliform in the creek. This can be explained by the fact that there is a horse pasture just above this sampling point.

Dogs are a potential source of bacteria. There are 66 licensed or registered puppy farms in Barry County, the highest concentration for any county in Missouri. The waste from dog farms consists of approximately 50 percent solids and 50 percent liquid. All waste has to be carried away from the facility to avoid health or odor problems in the operation. There are no regulations on the disposal of this waste and it is often spread in a nearby field.

#### **Septic tanks**

The Barry County Census indicates that there were 15,964 housing units in 2000, 13,398 of which were occupied with an average of 2.5 people. The 1990 census indicates that 67.4 percent of these occupied units were not connected to a public sewage system, i.e. they used a septic tank for sewage disposal. Assuming the same percentage for 2000, that would represent 9,030 units in Barry County. Assuming that the distribution of units that use on-site sewage disposal is uniform across Barry County, the number of individual septic systems in the upper Shoal Creek Watershed is estimated to be 1,005.

#### **Wildlife**

The deer population in Barry County is estimated to be 5,724-7,216. In the absence of additional data to determine the distribution of deer within Barry County, a uniform distribution was used that results in 68-86

acres/deer or 2.9-3.6 deer/km<sup>2</sup>.

There are two point sources that have a continuous discharge:  
Camp Barnabas (MO-0125164)  
Butterfield WWTF (MO-0126292)

EPA agrees all sources of bacteria have been considered within the Shoal Creek TMDL. This is a phase II TMDL for Shoal Creek (WBID 3230). All sources are the same as the previous phase I TMDL, but now are applied to the three new segments/tributaries (3231, 3232, 3233).

### Allocation - Loading Capacity

*Submittal identifies appropriate WLA for point, and load allocations for nonpoint sources. If no point sources are present the WLA is stated as zero. If no nonpoint sources are present, the LA is stated as zero [40 CFR § 130.2(i)]. If this is a phase II TMDL the change in LC will be documented in this section.*

The SWAT model was used to simulate Fecal coliform loading. The methodology relies on a mathematical computer simulation that calculates bacteria loads and concentrations. Both Fecal coliform and E. coli were used in this study.

Phase I LC was:  
Shoal 3230 = 4.4492E+11 cfu/day

The only modification to the previous phase I TMDL was the addition of the other three segments including WLA, LA, and MOS.

### WLA Comment

*Submittal lists individual WLAs for each identified point source [40 CFR § 130.2(h)]. If a WLA is not assigned it must be shown that the discharge does not cause or contribute to WQS excursions, the source is contained in a general permit addressed by the TMDL, or extenuating circumstances exist which prevent assignment of individual WLAs. Any such exceptions must be explained to a satisfactory degree. If a WLA of zero is assigned to any facility it must be stated as such [40 CFR § 130.2(i)]. If this is a phase II TMDL any differences in phase I and phase II WLAs will be documented in this section.*

As load contributors, the facilities' potential for contribution is relatively small. The WLAs are based on the maximum daily limit at design flow conditions. The permits include fecal coliform limits of 1000 colonies/100 ml daily maximum and a monthly average of 400 colonies/100 ml.

At the 15-50% flow probability:  
Shoal 3230 = 4.5455E+08 cfu/day  
Camp Barnabas (MO-0125164) 4.5455E+08 cfu/day  
Butterfield WWTF (MO-0126292) 2.2879E+9 cfu/day  
George's Processing, Inc. (MO-0108618) WLA of zero.  
The WLAs for all CAFOs are zero.

Phase I WLA was:  
Shoal 3230 = 4.5455E+08 cfu/day

The only modification to the previous phase I TMDL was the addition of the other three segments including WLA, LA, and MOS.

### LA Comment

*Includes all nonpoint sources loads, natural background, and potential for future growth. If no nonpoint sources are identified the LA must be given as zero [40 CFR § 130.2(g)]. If this is a phase II TMDL any differences in phase I and phase II LAs will be documented in this section.*

At the 15-50% flow probability:  
Shoal 3230 = 3.0349E+11 cfu/day  
Shoal 3231 = 6.4469E+10 cfu/day  
Joyce 3233 = 6.3057E+10 cfu/day

Pogue 3232 = 4.3604E+10 cfu/day

Phase I LA was:

Shoal 3230 = 3.0349E+11 cfu/day

The only modification to the previous phase I TMDL was the addition of the other three segments including WLA, LA, and MOS.

### Margin of Safety

*Submittal describes explicit and/or implicit MOS for each pollutant [40 CFR § 130.7(c)(1)]. If the MOS is implicit, the conservative assumptions in the analysis for the MOS are described. If the MOS is explicit, the loadings set aside for the MOS are identified and a rationale for selecting the value for the MOS is provided. If this is a phase II TMDL any differences in MOS will be documented in this section.*

The MOS is explicit. The standard deviation (SD) of the flows that occur with that frequency was calculated and multiplied by 200 colonies/100 ml to obtain the SD of the LC. These SDs were then averaged within each flow segment. Results for the MOS are below.

At the 15-50% flow probability:

Shoal 3230 = 1.4097E+11 cfu/day

Shoal 3231 = 7.1632E+09\* cfu/day

Joyce 3233 = 1.4360E+10 cfu/day

Pogue 3232 = 1.4236E+10 cfu/day

\*MOS as determined by SD exceeded the calculated LC, so a standard MOS of 10% was substituted.

Phase I MOS was:

Shoal 3230 = 1.4097E+11 cfu/day

The only modification to the previous phase I TMDL was the addition of the other three segments including WLA, LA, and MOS.

### Seasonal Variation and Critical Conditions

*Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s) [40 CFR § 130.7(c)(1)]. Critical conditions are factors such as flow or temperature which may lead to the excursion of WQS. If this is a phase II TMDL any differences in conditions will be documented in this section.*

Shoal Creek is designated for whole body contact recreation during the period from April 1 to October 31. During this season, human activities increase in and around the stream. The TMDL associates a daily load to every flow. The critical season extends from June to October when the flow is at its lowest and stream use is at its peak.

### Public Participation

*Submittal describes required public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s) [40 CFR § 130.7(c)(1)(ii)].*

Steering Committee formed to provide input into the FAPRI's study. Public meetings were held. The 30-day public notice was from August 10 to September 9, 2007 notices were mailed out and a copy was located on the internet web site. No comments were received during the public comment period.

### Monitoring Plan for TMDL(s) Under Phased Approach

*The TMDL identifies a monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of WQS, and a schedule for considering revisions to the TMDL(s) (where phased approach is used) [40 CFR § 130.7].*

Stream monitoring has been included in a 319 subgrant entitled "Upper Shoal Creek on-site System Implementation" (G07-NPS-04). This project runs from 2007 through 2011. Monitoring will be conducted by two organizations. The Missouri Stream Team Program's Volunteer Water Quality Monitoring (five monitoring

sites sampled every month )and professional water quality monitoring. Sampling will be conducted at least twice per month for 12 months over two years (48 sampling events) at a minimum of two sites.

Monitoring has continued in the Shoal Creek Watershed since the approval of the phase I TMDL in 11/18/2003. This monitoring has led to the addition of Shoal Creek (3231) and two tributaries Joyce (3233) and Pogue (3232) Creeks.

### **Reasonable Assurance**

*Reasonable assurance only applies when less stringent WLAs are assigned based on the assumption of nonpoint source reductions in the LA will be met [40 CFR § 130.2(i)]. This section can also contain statements made by the state concerning the state's authority to control pollutant loads.*

All discharging point sources in the watershed have a WLA sufficient to meet WQS. Therefore, reasonable assurances are not required. Reasonable assurance includes numerous authorities and funding.